

1. A multi-needle quilting machine comprising:
 - a frame;
 - a material drive operable to move a substrate relative to the frame;
 - at least one stitching-element bridge assembly moveable relative to a frame and to a substrate when stationary in the frame, the bridge having mounted thereon a plurality of selectively operable stitching element head assemblies;
 - a controller operable to control the operation of the material drive, the at least one bridge and the stitching elements to stitch a selected pattern.

2. A selectively operable stitching-element head assembly for a multi-needle quilting machine comprising:
 - a stitching-element holder;
 - a stitching-element drive operable to reciprocate the holder when active;
 - an input driving member;
 - a clutch operable to selectively connect or disconnect the drive, respectively to or from the input driving member, to respectively activate or deactivate the stitching-element drive.

3. The stitching-element bridge assembly comprising the head assembly of claim 2 and further comprising:
 - a bridge;
 - the stitching-element assembly having a housing;
 - the stitching-element assembly being attached to the bridge so that the housing structurally stiffens the bridge.

4. A looper drive assembly for a multi-needle quilting machine comprising:
 - a looper holder operable to move a looper in an oscillatory motion in a plane;
 - a looper assembly housing;
 - a looper drive mounted to the housing and operable to oscillate the holder;
 - an input driving member coupled to the drive;
 - mounting structure including:
 - a coupling configured to link the drive to a drive element of a quilting machine,
 - clamping structure configured to hold the assembly to a support at a sewing station,

adjustment elements configured to adjust the position of the looper in three mutually perpendicular dimensions relative to a needle at the sewing station and to adjust the phase of the looper drive relative to the input driving member.

5. The looper drive assembly of claim 4 wherein:

the coupling is configured to establish the adjustment of the position of the looper toward and away from the needle and the adjustment of the phase of the looper drive relative to the input driving member;

the clamping structure is configured to establish the adjustment of the position of the looper in a direction perpendicular to the needle in the plane; and

the looper drive is operable to establish the adjustment of the position of the looper in a direction perpendicular to the needle and the plane.

6. A method of positioning thread tails in a multi-needle quilting machine comprising:

with a needle in a retracted position spaced from the face of the material to be sewn and a top-thread tail extending from the needle on the needle side of the material, operating the needle through a first stitch cycle, to thereby poke the top-thread tail through the material, at a starting position on the material, to below the material where it is caught by a looper;

with the tension applied to the top thread, moving the needle along a path relative to the material a distance away from and back to the starting position, the distance being sufficient to pull the top-thread tail to the looper side of the material but insufficient to pull the top-thread tail out of the material;

7. The method of claim 6 wherein:

the path is a line, an arc, a triangle or some other combination of lines and arcs.

8. The method of claim 6 wherein:

the moving of the needle relative to the material is implemented by holding the material stationary and moving the needle on a bridge along the path.

9. The method of claim 6 further comprising:

before the first stitch cycle and at the end of the previous sewing of a pattern sequence, with the top thread extending from a top-thread supply through a top-thread tensioner to the needle, releasing

tension on the top thread and pulling off slack in the top thread between the supply and the needle;
then

moving the needle a short distance relative to the material that is sufficient to pull the slack in the top thread through the needle to add a length of thread tail between the needle and the material;
and then

cutting the top thread on the looper side of the material below the material to create the top-thread tail extending from the needle through the material to the looper side of the material.

10. The method of claim 9 further comprising:

with the tension applied to the top thread, moving the needle relative to the material a distance sufficient to pull the top-thread tail to the needle side of the material.

11. A method of starting a chain stitching sequence in a quilting operation with a needle thread from a needle and a looper thread from a looper, the method comprising:

with a needle thread tail extending from the needle to a top-thread end on a needle side of a material to be quilted, and with a looper thread tail extending from the looper to a looper thread end on a looper side of a needle plate, controlling the looper thread upon starting the chain stitching sequence such that a loop in the needle thread is picked up by the looper before a loop in the looper thread is picked up by the needle.

12. The method of claim 11 wherein the controlling of the looper thread includes:

upon the starting of the chain stitching sequence, driving the looper separate from the needle in a stitching cycle to a retracted looper position without driving the needle to its descended needle position; then

driving the needle to a descended needle position, without picking up a loop in the looper thread, at which position both the needle and looper are advanced through a portion of a first stitching cycle;
then

driving the needle and looper in coordination through the end of the first stitching cycle and thereby picking up a needle thread loop with the looper.

13. The method of claim 11 wherein the controlling of the looper thread includes:

manipulating the direction of the looper tail extending from the looper with an active element engaging the looper thread tail.

14. The method of claim 11 wherein the controlling of the looper thread includes:
restricting the direction of the looper tail extending from the looper with a passive surface adjacent the looper.

15. A method of quilting a substrate with a multi-needle quilting machine having at least two rows of stitching elements comprising:

with stitching elements of the at least two rows activated, stitching a first pattern with the rows of stitching elements while imparting relative longitudinal movement in a net forward direction between the stitching elements and the substrate; then

deactivating a first row of the stitching elements at a first set of final longitudinal positions on the substrate; then,

with the stitching elements of the first row deactivated, further stitching the first pattern with a second row of the stitching elements while imparting additional relative longitudinal movement of a first given longitudinal distance in a net forward direction between the stitching elements and the substrate; then

deactivating the second row of the stitching elements at a second set of final longitudinal positions on the substrate having a predetermined relationship to the first set of final longitudinal positions; then,

maintaining the stitching elements of the first row at a first set of starting longitudinal positions; then

activating the first row of the stitching elements at the first set of starting longitudinal positions on the substrate; then,

with the stitching elements of the first row activated, stitching a second pattern with the first row of the stitching elements while imparting additional relative longitudinal movement a second given distance in a net forward direction between the stitching elements and the substrate; then

activating the second row of the stitching elements at a second set of starting longitudinal positions on the substrate having a predetermined relationship to the first set of starting longitudinal positions; then,

with stitching elements of the first and second rows activated, further stitching the second pattern with the rows of stitching elements while imparting relative longitudinal movement in a net forward direction between the stitching elements and the substrate;

whereby, the first and second final longitudinal positions of the first pattern are less than the first given longitudinal distance apart and the first and second starting longitudinal positions of the second pattern are less than the second given longitudinal distance apart.

16. A method of quilting a substrate with a multi-needle quilting machine having at least two rows of stitching elements comprising:

with stitching elements of the at least two rows activated, stitching a first pattern with the rows of stitching elements while imparting relative longitudinal movement in a net forward direction between the stitching elements and the substrate; then

deactivating a first row of the stitching elements at a first set of final longitudinal positions on the substrate; then,

with the stitching elements of the first row deactivated, further stitching the first pattern with a second row of the stitching elements while imparting additional relative longitudinal movement a first given longitudinal distance in a net forward direction between the stitching elements and the substrate; then

deactivating the second row of the stitching elements at a second set of final longitudinal positions on the substrate having a predetermined relationship to the first set of final longitudinal positions; then,

with the stitching elements of the first and second rows deactivated, imparting relative longitudinal movement in a net backward direction between the stitching elements and the substrate until the stitching elements of the first row are at a first set of starting longitudinal positions less than the given longitudinal distance from the final longitudinal positions of the first set; then

activating the first row of the stitching elements at the first set of starting longitudinal positions on the substrate; then,

with the stitching elements of the first row activated, stitching a second pattern with the first row of the stitching elements while imparting additional relative longitudinal movement a second given distance in a net forward direction between the stitching elements and the substrate; then

activating the second row of the stitching elements at a second set of starting longitudinal positions on the substrate having a predetermined relationship to the first set of starting longitudinal positions; then,

with stitching elements of the first and second rows activated, further stitching the second pattern with the rows of stitching elements while imparting relative longitudinal movement in a net forward direction between the stitching elements and the substrate;
whereby, the first and second patterns are stitched on the substrate less than the given distance apart.

17. The method of claim **16** further comprising:
sewing a series of tack stitches with stitching elements of a row when deactivating or activating the stitching elements thereof.

18. The method of claim **16** further comprising:

providing a first bridge having the first row of stitching elements thereon and a second bridge having the second row of stitching elements thereon, each of the bridges being separately moveable relative to a frame and relative to each other;

the stitching of the first pattern with the rows of stitching elements being carried out with the bridges stationary and while imparting relative longitudinal movement in a net forward direction of the substrate relative to the frame;

the further stitching of the first pattern with the second row of the stitching elements is carried out with the substrate stationary and while imparting the additional relative longitudinal movement by moving the bridges in a net backward direction relative to the frame;

the imparting of relative longitudinal movement in a net backward direction is carried out with the substrate stationary and moving the bridges in a net forward direction relative to the frame;

the stitching of the second pattern with the first row of the stitching elements is carried out with the bridges stationary and imparting additional relative longitudinal movement of the substrate in a net forward direction relative to the frame; and

the further stitching of the second pattern with the rows of stitching elements is carried out with the bridges stationary and imparting relative longitudinal movement in a net forward direction of the substrate relative to the frame.

19. A looper head assembly for a quilting machine having a looper that oscillates between a retracted position and an extended position in a given path and a looper thread deflector fixed adjacent to the extended position of the looper to position the looper thread upon start up of the sewing of a pattern.

20. A tack stitch sequence method for a quilting machine comprising:

executing a startup stitch cycle on a substrate with stitching elements of the quilting machine;

then

sewing one or more long stitches by skipping a plurality of stitch lengths then executing another stitch cycle; then

sewing a plurality of single stitch length stitches, including stitches sewn over the long stitches;

sewing a plurality of single stitch length stitches of a pattern while feeding the stitching elements relative to the substrate at a generally continuous speed;

intermittently feeding the stitching elements relative to the substrate such that the stitching elements move at a relatively higher speed relative to the substrate at least when the stitching elements are free of the substrate during the sewing of the long stitches and at a relatively low speed when stitching elements are penetrating the substrate during the sewing of the long stitches.

21. The method of claim **20** wherein the length of the long stitches is approximately three times the length of the single stitch length stitches.